

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE		2. REPORT TYPE Professional Paper		3. DATES COVERED	
4. TITLE AND SUBTITLE HAILSS Aircraft Integration Tests				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) William Reason				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Air Warfare Center Aircraft Division 22347 Cedar Point Road, Unit #6 Patuxent River, Maryland 20670-1161				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Air Systems Command 47123 Buse Road Unit IPT Patuxent River, Maryland 20670-1547				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The Helicopter Aircrew Integrated Life Support System (HAILSS) ensemble is an impermeable coverall designed for protection in the Chemical and Biological threat arena. Additionally, the garment can be used as an anti-exposure system because the impermeable fabric effectively makes the garment a dry suit. It has booties sewn and sealed at the ankles and butyl rubber neck and wrist seals. The system employs a mesh spacer material that provides for conditioned air flow through the garment with one-way check valves on each lower sleeve for conditioned air exhaust. The entire ensemble is worn over a skin tight moisture wicking underwear. The systems is provided with protective head gear including a modified HGU-56/P two-part helmet with an integrated hood that provides for goggle demisting and aviator respiration.					
15. SUBJECT TERMS Helicopter Aircrew Integrated Life Support System (HAILSS)					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			William Reason
Unclassified	Unclassified	Unclassified	Unclassified	5	19b. TELEPHONE NUMBER (include area code) (301) 342-9018

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18

20000607 026

Helicopter Aircrew Integrated Life Support System HAILSS Aircraft Integration Testing

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Abstract

The Helicopter Aircrew Integrated Life Support System (HAILSS) ensemble is an impermeable coverall designed for protection in the Chemical and Biological threat arena. Additionally the garment can be used as an Anti-exposure system because the impermeable fabric effectively makes the garment a dry suit. It has booties sewn and sealed at the ankles and butyl rubber neck and wrist seals. The system employs a mesh spacer material that provides for conditioned air flow through the garment with one-way check valves on each lower sleeve for conditioned air exhaust. The entire ensemble is worn over a skin tight moisture wicking underwear. The system is provided with protective head gear including a modified HGU-56/P two-part helmet with an integrated hood that provides for goggle demisting and aviator respiration.

Background

In an effort to ensure that the HAILSS ensemble was ready for flight-testing and a viable system for technology insertion, a decision was made to conduct cockpit integration ground tests. The test were conducted with subjects donned in the garment with flight equipment that was representative of what is presently used or expected to be used in the near future by US Navy and Marine Corps aviators. The cooling for these tests was a modified SAB-87 Chemical filtrated blower used by the Austrian army. The modification of the

blower mounting mechanism allowed for easy attachment to the survival vest and was designated for the purpose of our tests the SAB/N. Since test completion, final work on the Aircrew Personal Air Conditioning System (APACS) has been completed.

Platform Selection

It is recognized that military Chemical / Biological ensembles have historically been bulky and provided little in the way of comfort or thermal burden relief to the aviator. With this in mind, it was decided to conduct testing on aircraft that presented the most challenge to the ensemble. Clearly, the best choice for this test was the AH-1W Cobra attack Helicopter.



Additionally, the Integrated Product Team (IPT) for Aircrew System of the V-22 Osprey requested that we conduct integration and suitability tests in that aircraft. The Rotary Wing Test Squadron at the Naval Air Station, Patuxent River, Maryland provided a Cobra for ground testing in April 1999.

The Osprey was provided for testing in August 1999 also at Patuxent River, MD.

Test Methodology

Aircraft availability limited our tests to only two subjects in the Cobra and one subject in the Osprey. The purpose of our tests was to establish how well the ensemble integrated with the Cobra and Osprey cockpits.



Through Cobra pilot interviews it was determined that there were three primary areas, on which our test team should focus. First and most importantly is a maneuver that occurs on the ground during what is known as the "hot crew swap". This maneuver entails the aviators egressing and ingressing the cockpit with the main rotor engaged. Great care is taken to avoid bumping the cyclic flight control input stick in the aft cockpit, for obvious reasons. The forward cockpit employs a right side mounted cyclic stick, making that cockpit less apt to uncommanded flight control input with the main rotor engaged. Next, was an aviator's ability to reach various mission essential switches and knobs on the instrument panels and thirdly, the aviator's ability to input full cyclic and collective stick motion while donned in the garment.

Cobra Test

Integration and aircraft fit tests were started with the AH-1W Cobra attack helicopter. The test subject donned the HAILSS garment with limited assistance. The flight survival gear included the Airsave (CMU-33/P) vest configured with the SAB/N blower and Low Profile Floatation Collar (LPFC) LPU-34/P. This test was conducted using headgear based on the standard US Navy HGU-84/P, as it represented the most viable strategy for system deployment at the time of the test. It should be noted however, that the two part modified HGU-56/P delivered with the HAILSS prototype is a better fitting helmet with improved airflow characteristics. During the garment baseline trials, discoveries were made that indicated the garment needed to be more flexible in the knee region. Modifications to the mesh liner included using a thinner mesh (6 millimeter) in several frontal regions of the spacer.

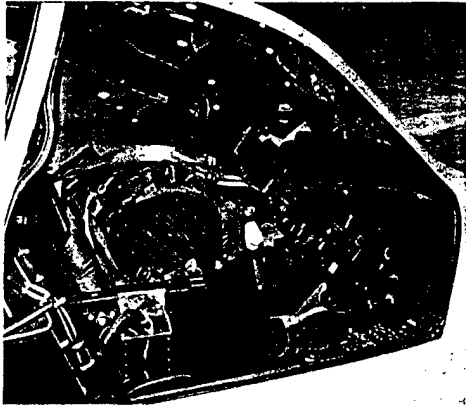


This modification ultimately provided for a considerable increase in flexibility in and around the knee and greater overall mobility while donned in the garment.

Forward Cockpit

The host squadron briefed our test subjects on the proper method of ingress to each of the cockpits and conducted a cockpit safety indoctrination. The forward flight

station was the first position tested. Ingress to the forward cockpit was accomplished with relative ease, no snag hazards were noted and strap-in, although assisted was not overly difficult given the added bulk of the garment in the hip region. Both subjects easily reached all switches and knobs at the extreme corners of the instrument panel and demonstrated complete cyclic and collective stick input authority.



Each subject demonstrated that they could also fully operate and were capable of unrestricted use of the forward cockpit visual weapons targeting system. Egress from the forward cockpit was performed without incident. One subject who had previously worn the baseline ensemble indicated a marked improvement in comfort while donned in this prototype ensemble over the baseline units. Shortly after the airflow was established he indicated that the airflow to the leg region was considerably better than that of the baseline and the comfort level in the headgear exceeded that of the AR-5 headgear. The air flowing through the helmet liner to provide de-misting for the goggles also apparently provided for a degree of cooling in the head region.

Aft Cockpit

The prototype system with the improved knee flexion and modified

blower assembly allowed our medium anthropometric sized subject to ingress the cockpit with relative ease on the first attempt. There was sufficient flexibility in the knee for him to lift his left leg high enough to enter the cockpit in the proper fashion. Each subject again demonstrated the necessary reach and full flight control input authority required for safe flight.

V-22 Osprey

The aircraft used for our test was an Engineering, Manufacturing and Development (EMD) model provided by the Integrated Product Team (IPT) in Patuxent River, MD.

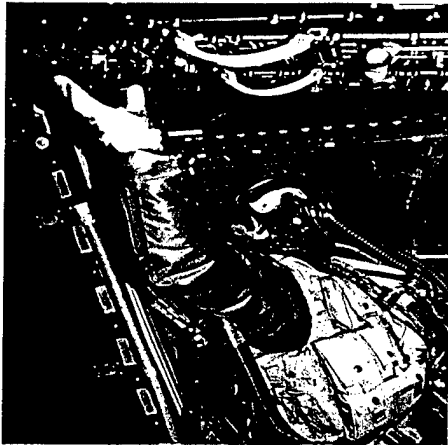


This aircraft cockpit is not configured in a pilot/co-pilot configuration as in traditional helicopters and fixed wing aircraft. Instead, each flight position is configured identically allowing each aviator complete autonomous flight authority.

Right Seat

Our test subject donned the ensemble with limited assistance and began ingress to the right seat. This proved somewhat difficult in that this aircraft was configured with test flight data instrumentation and recorders.

These units installed between the seats will not be in the production model of the aircraft. The subject was able to reach the extreme corners of the instrument panels designated for that seat and demonstrated the full range of cyclic stick / Thrust control lever (TCL) authority.

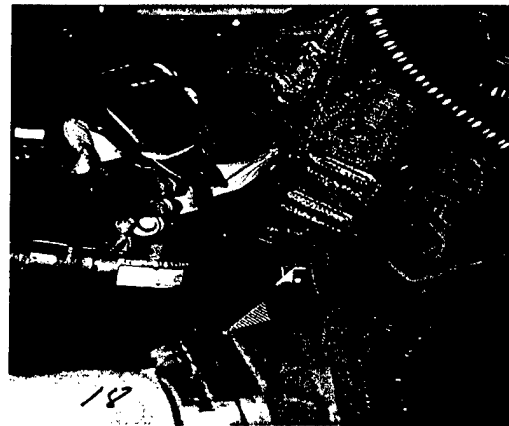


The only problem noted was the subjects limited field of view (FOV) to the lower portion of the mission Computer Display Unit (CDU) selection panel.

Left Seat

The seats in the EMD aircraft and the initial production aircraft adjust on a single diagonal axis. The extreme points are full down and aft and full up and forward. The rudder pedals have an adjustment of seventeen inches. This has, at times allowed for bulky ensembles to place the aviator in a position where full aft cyclic stick input caused contact between the cyclic stick handle and the release mechanism of the five point crew harness buckle. It was our intention to test the HAILSS prototype ensemble to this anomaly. After securely strapping into the seat, our subject adjusted the rudder pedals to his optimum effective throw. The subject then performed the test routine for reach and flight control input with no

discrepancies noted except the still limited downward FOV. Finally the subject was asked to pull the cyclic stick full aft and attempt to make contact with the release buckle, the result being a clearance of a little more than an inch. Although considered a resounding success, it should be noted that an even greater improvement to this clearance should be anticipated for two reasons.



First, our ensemble was tested using the rather bulky SAB/N blower assembly; the follow-on APACS system is expected to be considerably less bulky. Secondly, the Osprey Aircrew Systems IPT has completed a trade study for a multiple axis adjusting seat that is anticipated to be inserted after production begins as an Engineering Change Proposal (ECP) or as a larger Pre-Planned Product Improvement (P3I) effort to the aircraft.

Future Testing

The ensemble and its capabilities were recently presented and favorably reviewed by US Navy acquisition officials. The next major test of the ensemble for integration will be to conduct initial flight tests.

Discussion Conclusion

The system still requires a great deal of integration testing in a broader application of platforms. However it should be pointed out and recognized that this integration testing was conducted while the program was still a Science and Technology effort.



Something that is quite unprecedented, in that this sort of testing is not usually even begun until a program has been transitioned into an EMD acquisition effort. It is a testament to the forward thinking of the Navy Aircrew Systems Science and Technology staff to ensure a system is ready for transition and flight testing while it's still in the S & T stages. Discovering and correcting, well in advance of EMD, potential aspects of a system that could otherwise prove to difficult or costly to pursue as viable acquisition programs to protect our military' aviators.

Acknowledgements

The author would like to thank the members of the test team without whose help this testing would have been not nearly as successful. Stephen Coleman, William Davis and Alan McMinn, all active duty members of the US Navy. Mr. Paul Dolinar, HAILSS program management staff. Mr. Ron Cresini and Mr. Rick Loeslien, Aircrew

System, V-22 Osprey IPT engineering staff.

Biography

William Reason is an Engineering Technician assigned to the Naval Air Warfare Center Aircraft Division at Patuxent River, MD. He is the Aircrew Ground and Inflight Test laboratory manager. As a retired U.S. Navy Aircrew Survival Equipmentman, he offers a unique talent and ability to Aircrew ensemble/Aircraft cockpit design and integration. Mr. Reason's experience spans twenty-five years in aviation and survival systems. Mr. Reason was designated by the U.S Navy as an Aviation Safety Specialist and has held a board membership on various ordnance certification programs. His last seven years of active duty military service found him assigned to three Quality Assurance inspection divisions, earning him recognition for accomplishments in Aviation Safety from the Commander, Naval Air Forces, Atlantic Fleet. Mr. Reason is a member of the Society of Engineers and Scientists at the Naval Air Warfare Center, Patuxent River, MD.

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